

We claim:

1. A surge composite, comprising:
a non-absorbent, wettable fibrous surge material;
a plurality of discrete regions in the surge material; and
a superabsorbent material bonded to the fibers in at least some of the regions.
2. The surge composite of Claim 1, wherein the non-absorbent, wettable fibrous surge material is a treated non-absorbent hydrophobic fibrous material.
3. The surge composite of Claim 1, wherein the discrete region has a surface area on at least one of a first surface and a second surface of the surge composite of about 5% to 80%.
4. The surge composite of Claim 3, wherein the discrete region has a surface area on at least one of the first surface and the second surface of the surge composite of about 10% to 70%.

5. The surge composite of Claim 4, wherein the discrete region has a surface area on at least one of the first surface and the second surface of the surge composite of about 15% to 60%.

6. The surge composite of Claim 1, wherein at least one of the plurality of discrete regions extends through a length of a thickness of the surge material.

7. The surge composite of Claim 6, wherein at least one of the plurality of discrete regions extends through the entire length of the thickness of the surge material.

8. The surge composite of Claim 1, wherein at least one of the discrete regions comprises a different size.

9. The surge composite of Claim 1, wherein at least one of the discrete regions comprises a different shape.

10. The surge composite of Claim 9, wherein the discrete regions comprise at least two different shapes.

11. The surge composite of Claim 6 wherein at least one of the plurality of discrete regions extends through about 10% to 95% of the length of the thickness of the surge material.

12. The surge composite of Claim 11, wherein at least one of the plurality of discrete regions extends through about 20% to 90% of the length of the thickness of the surge material.

13. The surge composite of Claim 6, wherein at least one of the discrete regions comprises a superabsorbent material gradient.

14. The surge composite of Claim 1, wherein the surge composite comprises about 1% to 400% superabsorbent add-on level based on weight of the surge material.

15. The surge composite of Claim 1, wherein the surge composite comprises about 5% to 300% superabsorbent add-on level based on weight of the surge material.

16. The surge composite of Claim 1, wherein the surge composite comprises about 10% to 200% superabsorbent add-on level based on weight of the surge material.

17. The surge composite of Claim 1, wherein the regions in which the superabsorbent material is bonded to the fibers have a plurality of microscopic pores when viewed in an X-Y plane.

18. The surge composite of Claim 17, wherein the plurality of microscopic pores have a pore size of between 50 and 500 microns.

19. The surge composite of Claim 17, wherein the plurality of microscopic pores have a pore size of between 50 and 300 microns.

20. The surge composite of Claim 17, wherein the plurality of microscopic pores have a pore size of between 50 and 200 microns.

21. The surge composite of Claim 1, wherein the superabsorbent material is bonded to the surge material by drying and crosslinking a superabsorbent precursor solution.

22. The surge composite of Claim 1, wherein the superabsorbent material is applied to the discrete regions of the surge material by one of printing, spraying, and dipping.

23. The surge composite of Claim 1, wherein the surge material comprises a spunbond web.

24. The surge composite of Claim 1, wherein the surge material comprises a meltblown web.

25. The surge composite of Claim 1, wherein the surge material comprises a bonded carded web.

26. The surge composite of Claim 21, wherein the superabsorbent precursor comprises a hydrolyzed copolymer of an α -olefin, an α,β -ethylenically unsaturated organic acid anhydride or ester, and one or more of a non-polymerizable latent crosslinker.

27. The surge composite of Claim 1, wherein the regions in which the superabsorbent material is bonded to the fibers have a layered structure with space between adjacent layers when viewed in a cross-section.

28. The surge composite of Claim 27, wherein the space between adjacent layers separates the adjacent layers by 50 to 300 microns.

29. The surge composite of Claim 27, wherein the space between adjacent layers separates the adjacent layers by 50 to 200 microns.

30. The surge composite of Claim 27, wherein the space between adjacent layers separates the adjacent layers by 50 to 150 microns.

31. The surge composite of Claim 21, wherein the superabsorbent precursor comprises a hydrolyzed copolymer of isobutylene and maleic anhydride and one or more of a nonpolymerizable latent crosslinker.

32. The surge composite of Claim 26, wherein the non-polymerizable latent crosslinker is selected from the group consisting of ethylene glycol, diethylene glycol, triethylene glycol, polyethelene glycol, polyvinyl alcohol, polyethylele oxide, glycerol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol, 1,1,1-trimethylolpropane, 1,4-butanediamine, 1,5-pentanediamine, 1,6-hexanediamine, diethylenetriamine, and analogs and derivatives thereof.

33. The surge composite of Claim 21, wherein the superabsorbent precursor comprises a hydrolyzed copolymer of an α -olefin, an α,β -ethylenically unsaturated organic acid anhydride or ester, and a polyvalent metal ion crosslinker.

34. The surge composite of Claim 33, wherein the polyvalent metal ion crosslinker is selected from the group consisting of Al^{3+} , Zr^{4+} , Fe^{2+} , Fe^{3+} , Ca^{2+} , Ti^{3+} , and Cr^{3+} .

35. The surge composite of Claim 21, wherein the superabsorbent precursor comprises a copolymer of acrylic acid with a polymerizable latent crosslinker.

36. The surge composite of Claim 35, wherein the polymerizable latent crosslinker is selected from the group consisting of ethylene glycol allyl ether, 2-hydroxyethyl methacrylate, polyethylene glycol methacrylate, ethylene glycol vinyl ether, aminopropyl vinyl ether, and any compound having an α,β -ethylenically unsaturated group and one or more functional groups which react with a carboxyl group.

37. The surge composite of Claim 21, wherein the superabsorbent precursor comprises a polyacrylic acid and a nonpolymerizable latent crosslinker.

38. The surge composite of Claim 37, wherein the non-polymerizable latent crosslinker is selected from the group consisting of ethylene glycol, diethylene glycol, triethylene glycol, polyethelene glycol, polyvinyl alcohol, polyethylele oxide, glycerol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol, 1,1,1-trimethylolpropane, 1,4-butanediamine, 1,5-pentanediamine, 1,6-hexanediamine, diethylenetriamine, and analogs and derivatives thereof, and any compound having an .

39. The surge composite of Claim 21, wherein the superabsorbent precursor comprises a polyacrylic acid and a polyvalent metal ion crosslinker.

40. The surge composite of Claim 39, wherein the polyvalent metal ion crosslinker is selected from the group consisting of Al^{3+} , Zr^{4+} , Fe^{2+} , Fe^{3+} , Ca^{2+} , Ti^{3+} , and Cr^{3+} .

41. The surge composite of Claim 1, wherein the superabsorbent material comprises one selected from the group consisting of hydrolyzed partially neutralized starch acrylonitrile graft copolymers, partially neutralized starch acrylic acid graft copolymers, partially neutralized saponified vinyl acetate-acrylester copolymers, hydrolyzed acronitrile copolymers, carboxymethyl cellulose, carboxymethyl starch, chitosan salts, partially neutralized polyaspartic acid,

polyquarternary ammonium salts, polyvinyl amines, polyethylene imines, and combinations thereof.

42. The surge composite of Claim 1, wherein the surge material has a density in a range from 0.010 to 0.100 grams per cubic centimeter.

43. The surge composite of Claim 1, wherein the surge material has a density in a range from 0.015 to 0.075 grams per cubic centimeter.

44. The surge composite of Claim 1, wherein the surge material has a density in a range from 0.020 to 0.050 grams per cubic centimeter.

45. The surge composite of Claim 1, wherein the surge material has a permeability in a range from 500 to 6000 Darcys.

46. The surge composite of Claim 1, wherein the surge material has a permeability in a range from 1000 to 4000 Darcys.

47. The surge composite of Claim 1, wherein the surge material has a permeability in a range from 1700 to 2500 Darcys.

48. The surge composite of Claim 1, wherein the surge material has a basis weight in a range from 0.5 to 10 ounces per square yard.

49. The surge composite of Claim 1, wherein the surge material has a basis weight in a range from 1 to 5 ounces per square yard.

50. The surge composite of Claim 1, wherein the surge material has a basis weight in a range from 1 to 3 ounces per square yard.

51. A diaper comprising the surge composite of Claim 1.

52. Training pants comprising the surge composite of Claim 1.

53. Swim wear comprising the surge composite of Claim 1.

54. An adult incontinence garment comprising the surge composite of Claim 1.

55. A feminine hygiene product comprising the surge composite of Claim 1.

56. A medical absorbent product comprising the surge composite of Claim 1.

57. An absorbent article, comprising:
a liquid-permeable body-side liner;
a surge material adjacent to the body-side liner;
a substantially liquid-impermeable outer cover adjacent to the surge material;
a plurality of discrete regions in the surge material; and
a superabsorbent material bonded to the surge material in at least some of the regions.

58. The absorbent article of Claim 57, wherein the surge material is a non-absorbent, wettable fibrous material.

59. The absorbent article of Claim 58, wherein the non-absorbent, wettable fibrous material is a treated non-absorbent hydrophobic material.

60. The surge composite of Claim 57, wherein the discrete region has a surface area on at least one of a first surface and a second surface of the surge material of about 5% to 80%.

61. The surge composite of Claim 57, wherein the discrete region has a surface area on at least one of a first surface and a second surface of the surge material of about 10% to 70%.

62. The surge composite of Claim 57, wherein the discrete region has a surface area on at least one of a first surface and a second surface of the surge material of about 15% to 60%.

63. The absorbent article of Claim 57, wherein at least one of the plurality of discrete regions extends through a length of a thickness of the surge material.

64. The absorbent article of Claim 63, wherein at least one of the plurality of discrete regions extends through an entire thickness of the thickness of the surge material.

65. The surge composite of Claim 64, wherein at least one of the plurality of discrete regions extends through about 10% to 95% of the thickness of the surge material.

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FOOTNOTES

66. The surge composite of Claim 64, wherein at least one of the plurality of discrete regions extends through about 20% to 90% of the thickness of the surge material.

67. The absorbent article of Claim 57, wherein the surge material is a substantially planar surge layer in an X-Y plane.

68. The absorbent article of Claim 57, wherein the superabsorbent material is applied to the discrete regions of the surge material by one of printing, spraying, and dipping.

69. The absorbent article of Claim 57, wherein the superabsorbent material is bonded to the surge material in the discrete region.

70. The absorbent article of Claim 69, wherein the superabsorbent material is bonded to the surge material by crosslinking a superabsorbent precursor.

71. The absorbent article of Claim 57, wherein the surge material comprises a superabsorbent add-on level of about 1% to 400% based on weight of the surge material.

72. The absorbent article of Claim 57, wherein the surge material comprises a superabsorbent add-on level of about 5% to 300% based on weight of the surge material.

73. The absorbent article of Claim 57, wherein the surge material comprises a spunbond web.

74. The absorbent article of Claim 57, wherein the surge material comprises a meltblown web.

75. The absorbent article of Claim 57, wherein the surge material comprises a bonded carded web.

76. The absorbent article of Claim 70, wherein the superabsorbent precursor comprises a hydrolyzed copolymer of an α -olefin and an α,β -ethylenically unsaturated organic acid anhydride or ester, and one or more of a non-polymerizable latent crosslinker.

77. The absorbent article of Claim 70, wherein the superabsorbent precursor comprises a hydrolyzed copolymer of isobutylene and maleic anhydride and one or more of a nonpolymerizable latent crosslinker.

78. The absorbent article of Claim 76, wherein the non-polymerizable latent crosslinker is selected from the group consisting of ethylene glycol, diethylene glycol, triethylene glycol, polyethelene glycol, polyvinyl alcohol, polyethylele oxide, glycerol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol, 1,1,1-trimethylolpropane, 1,4-butanediamine, 1,5-pentanediamine, 1,6-hexanediamine, diethylenetriamine, and analogs and derivatives thereof.

79. The absorbent article of Claim 70, wherein the superabsorbent precursor comprises a hydrolyzed copolymer of an α -olefin, an α,β -ethylenically unsaturated organic acid anhydride or ester, and a polyvalent metal ion crosslinker.

80. The absorbent article of Claim 79, wherein the polyvalent metal ion crosslinker is selected from the group consisting of Al^{3+} , Zr^{4+} , Fe^{2+} , Fe^{3+} , Ca^{2+} , Ti^{3+} , and Cr^{3+} .

81. The absorbent article of Claim 70, wherein the superabsorbent precursor comprises a copolymer of acrylic acid with a polymerizable latent crosslinker.

82. The absorbent article of Claim 81, wherein the polymerizable latent crosslinker is selected from the group consisting of ethylene glycol allyl ether, 2-hydroxyethyl methacrylate, polyethylene glycol methacrylate, ethylene glycol vinyl ether, aminopropyl vinyl ether, and any compound having an α,β -ethylenically unsaturated group and one or more functional groups which react with a carboxyl group.

83. The absorbent article of Claim 70, wherein the superabsorbent precursor comprises a polyacrylic acid and a nonpolymerizable latent crosslinker.

84. The absorbent article of Claim 83, wherein the non-polymerizable latent crosslinker is selected from the group consisting of ethylene glycol, diethylene glycol, triethylene glycol, polyethelene glycol, polyvinyl alcohol, polyethylele oxide, glycerol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol, 1,1,1-trimethylolpropane, 1,4-butanediamine, 1,5-pentanediamine, 1,6-hexanediamine, diethylenetriamine, and analogs and derivatives thereof.

85. The absorbent article of Claim 70, wherein the superabsorbent precursor comprises a polyacrylic acid and a polyvalent metal ion crosslinker.

86. The absorbent article of Claim 85, wherein the polyvalent metal ion crosslinker is selected from the group consisting of Al^{3+} , Zr^{4+} , Fe^{2+} , Fe^{3+} , Ca^{2+} , Ti^{3+} , and Cr^{3+} .

87. The absorbent article of Claim 57, wherein the superabsorbent material comprises one selected from the group consisting of hydrolyzed partially neutralized starch acrylonitrile graft copolymers, partially neutralized starch acrylic acid graft copolymers, partially neutralized saponified vinyl acetate-acrylester copolymers, hydrolyzed acronitrile copolymers, carboxymethyl cellulose, carboxymethyl starch, chitosan salts, partially neutralized polyaspartic acid, polyquartenary ammonium salts, polyvinyl amines, polyethylene imines, and combinations thereof.

88. An absorbent article, comprising:

- a liquid-permeable body-side liner;
- a surge material adjacent to the body-side liner;
- an absorbent core adjacent the surge material;
- a substantially liquid-impermeable outer cover adjacent to the absorbent core;
- a plurality of discrete regions in at least one of the surge material and the absorbent core; and

a superabsorbent material bonded to the least one of the surge material and the absorbent core in the discrete regions.

89. The absorbent article of Claim 88, wherein the surge material is a non-absorbent, wettable fibrous material.

90. The absorbent article of Claim 88, wherein at least one of the plurality of discrete regions extends through a length of a thickness of the at least one of the surge material and the absorbent core.

91. The absorbent article of Claim 90, wherein at least one of the plurality of discrete regions extends through the entire thickness of the at least one of the surge material and the absorbent core.

92. The absorbent article of Claim 88, wherein the surge material comprises a substantially planar surge layer in an X-Y plane.

93. The absorbent article of Claim 88, wherein the absorbent core comprises a substantially planar absorbent layer in an X-Y plane.

94. The absorbent article of Claim 88, wherein the superabsorbent material is applied to the discrete regions of the least one of the surge material and the absorbent core by one of printing, spraying, and dipping.

95. The absorbent article of Claim 88, wherein at least one of the surge material and the absorbent core comprise a superabsorbent add-on level of about 1% to 400% based on weight of the at least one of the surge material and the absorbent core.

96. The absorbent article of Claim 88, wherein the superabsorbent add-on level is about 5% to 300% based on weight of the at least one of the surge material and the absorbent core.

97. A method of applying superabsorbent material to surge material, comprising:

making a superabsorbent material precursor solution;
printing the superabsorbent precursor solution onto surge material;
drying the superabsorbent precursor; and
crosslinking the superabsorbent precursor.

98. The method of Claim 97, wherein the surge material comprises about 1% to 400% superabsorbent material add-on level based on weight of the surge material.

99. The method of Claim 97, wherein the surge material comprises about 5% to 300% superabsorbent material add-on level based on weight of the surge material.

100. The method of Claim 97, wherein the surge material comprises about 10% to 200% superabsorbent material add-on level based on weight of the surge material.

101. The method of Claim 97, wherein the superabsorbent material is printed into discrete regions of the surge material.

102. The method of Claim 100, wherein the regions in which the superabsorbent material is printed into the surge material have a plurality of microscopic pores when viewed in an X-Y plane.

103. The method of Claim 102, wherein the plurality of microscopic pores have a pore size of between 50 and 500 microns.

104. The method of Claim 97, wherein the surge material comprises a plurality of fibers selected from the group consisting of polypropylene fibers, polyethylene fibers, polyester fibers, webs of spunbonded polypropylene fibers, webs of spunbonded polyethylene fibers, webs of spunbonded polyester fibers, webs of rayon fibers, bonded carded webs of synthetic fibers, bonded carded webs of natural fibers, and combinations thereof.

105. The method of Claim 97, wherein the superabsorbent precursor precursor comprises a hydrolyzed copolymer of isobutylene and maleic anhydride and one or more of a nonpolymerizable latent crosslinker.

106. The method of Claim 97, wherein the superabsorbent precursor comprises a hydrolyzed copolymer of an α -olefin and an α,β -ethylenically unsaturated organic acid anhydride or ester, and one or more of a non-polymerizable latent crosslinker.

107. The method of Claim 106, wherein the non-polymerizable latent crosslinker is selected from the group consisting of ethylene glycol, diethylene glycol, triethylene glycol, polyethelene glycol, polyvinyl alcohol, polyethylele oxide, glycerol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-

octanediol, 1,1,1-trimethylolpropane, 1,4-butanediamine, 1,5-pentanediamine, 1,6-hexanediamine, diethylenetriamine, and analogs and derivatives thereof.

108. The method of Claim 107, wherein the superabsorbent precursor comprises a hydrolyzed copolymer of an α -olefin, an α,β -ethylenically unsaturated organic acid anhydride or ester, and a polyvalent metal ion crosslinker.

109. The method of Claim 108, wherein the polyvalent metal ion crosslinker is selected from the group consisting of Al^{3+} , Zr^{4+} , Fe^{2+} , Fe^{3+} , Ca^{2+} , Ti^{3+} , and Cr^{3+} .

110. The method of Claim 97, wherein the superabsorbent precursor comprises a copolymer of acrylic acid with a polymerizable latent crosslinker.

111. The method of Claim 110, wherein the polymerizable latent crosslinker is selected from the group consisting of ethylene glycol allyl ether, 2-hydroxyethyl methacrylate, polyethylene glycol methacrylate, ethylene glycol vinyl ether, aminopropyl vinyl ether, and any compound having an α,β -ethylenically unsaturated group and one or more functional groups which react with a carboxyl group.

112. The method of Claim 97, wherein the superabsorbent precursor comprises a polyacrylic acid and a nonpolymerizable latent crosslinker.

113. The method of Claim 112, wherein the non-polymerizable latent crosslinker is selected from the group consisting of ethylene glycol, diethylene glycol, triethylene glycol, polyethelene glycol, polyvinyl alcohol, polyethylele oxide, glycerol, 1,3-propanediol, 1,4-butanediol, 1,5-pentanediol, 1,6-hexanediol, 1,8-octanediol, 1,1,1-trimethylolpropane, 1,4-butanediamine, 1,5-pentanediamine, 1,6-hexanediamine, diethylenetriamine, and analogs and derivatives thereof.

114. The method of Claim 97, wherein the superabsorbent precursor comprises a polyacrylic acid and a polyvalent metal ion crosslinker.

115. The method of Claim 114, wherein the polyvalent metal ion crosslinker is selected from the group consisting of Al^{3+} , Zr^{4+} , Fe^{2+} , Fe^{3+} , Ca^{2+} , Ti^{3+} , and Cr^{3+} .

116. The method of Claim 97, wherein the superabsorbent material comprises one selected from the group consisting of hydrolyzed partially neutralized starch acrylonitrile graft copolymers, partially neutralized starch acrylic acid graft copolymers, partially neutralized saponified vinyl acetate-acrylester copolymers,

hydrolyzed acrylonitrile copolymers, carboxymethyl cellulose, carboxymethyl starch, chitosan salts, partially neutralized polyaspartic acid, polyquaternary ammonium salts, polyvinyl amines, polyethylene imines, and combinations thereof.

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